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Ultrasound-Based Diagnosis of Sudden Scrotal Enlargement in an Infant: A Case Report

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Abstract

Scrotal enlargement in infants has a variety of causes, ranging from benign conditions like hydrocele to more serious issues such as scrotal hernias or testicular tumors. We present the case of a 3-month-old infant with progressive right-sided scrotal swelling, diagnosed with a scrotal hernia through an urgent ultrasound examination. The ultrasound revealed intestinal loops within the scrotum, confirming the diagnosis and ruling out complications such as incarceration. This case underscores the pivotal role of ultrasonography as a first-line, non-invasive diagnostic tool for scrotal conditions in infants, facilitating timely surgical intervention and preventing long-term complications.

Introduction

Scrotal enlargement in infants presents a diagnostic challenge, as its causes range from benign conditions such as hydrocele to potentially serious issues like scrotal hernias or tumors. Rapid and accurate diagnosis is essential to guide appropriate treatment. Ultrasonography has emerged as a pivotal tool in the differential diagnosis due to its non-invasive nature and high sensitivity.

Ultrasonography not only offers non-invasive, real-time imaging but also achieves high diagnostic accuracy in detecting inguinal hernias and differentiating them from other scrotal abnormalities. Studies have reported sensitivity rates exceeding 95% for this modality in pediatric cases [1]. Its application in early-stage evaluation minimizes diagnostic delays and facilitates timely surgical intervention.

Ultrasound provides detailed visualization of structures in the scrotum and inguinal canal, facilitating early diagnosis of conditions like hernias or torsion, even in atypical cases [1]. The diagnostic accuracy of ultrasonography has been widely reported, making it indispensable in evaluating scrotal enlargement in the pediatric population [3].

Case Description

A 3-month-old male presented to the emergency department with progressive swelling of the right scrotum over several days. The swelling was associated with irritability and relentless crying but no fever or gastrointestinal symptoms. The mother denied any history of trauma or prior medical conditions.

Physical examination revealed an enlarged, tense right scrotum where the testicle could not be clearly palpated. The left scrotum was normal size, with a palpable testicle.

An urgent ultrasound examination was performed using a GE Healthcare LOGIQ F8 with a 7–12 MHz linear transducer. The imaging revealed hyperechoic intestinal loops within the right scrotum, showing active peristalsis and mixed gas and fluid content, obscuring the right testis. Additional findings included displaced intestinal loops moving from the abdominal cavity into the scrotal sac through the right inguinal canal [Fig.1, Fig.2, Fig.3]. The left testicle and inguinal canal were unremarkable, with normal size and echotexture. Importantly, peristalsis of the intestinal loops within the scrotum was preserved, excluding signs of strangulation or ischemia. Based on these findings, the patient was diagnosed with a right-sided scrotal hernia and referred to pediatric surgery for further management.

Treatment of Inguinal Hernia in Infants

The definitive treatment for inguinal hernia in infants is surgical correction. Timing and approach are influenced by the infant's age, clinical presentation, and surgical risk factors.

Open surgery remains the gold standard for infants due to its low recurrence rates [1]. This approach involves a small incision in the groin, dissection of the hernial sac, and closure at its base. Laparoscopic surgery, on the other hand, offers a minimally invasive alternative, typically reserved for older children. While laparoscopic repair is associated with faster recovery, it may carry a slightly higher risk of recurrence in younger infants, with rates reported between 3% and 5%, compared to less than 1–2% for open surgery [1,6].

In this case, the patient was scheduled for open surgical repair after reaching three months of age, allowing safe administration of inhalation anesthesia. Postoperative care included adequate pain management, wound care, and restriction of physical activity for one week to ensure proper healing.

Discussion

Scrotal hernias in infants must be carefully differentiated from other conditions causing scrotal enlargement, such as hydrocele, testicular torsion, epididymitis, spermatocele, hematocele, or even rare testicular neoplasms. Each of these conditions presents unique clinical and imaging characteristics, but overlapping symptoms can complicate the diagnosis.

The efficacy of ultrasonography in diagnosing inguinal hernias in children is well-documented. As a non-invasive and widely available tool, it significantly accelerates the diagnostic process and facilitates timely treatment, particularly in potentially life-threatening situations [3].

Hydrocele often presents as a painless swelling in the scrotum caused by the accumulation of fluid within the tunica vaginalis. It is typically characterized by its ability to transilluminate light, which helps distinguish it from other scrotal pathologies. Diagnosis is primarily clinical, with ultrasonography being employed in atypical or complicated cases to confirm the condition and rule out other differential diagnoses such as testicular torsion or infection. Communicating hydroceles, which involve an open connection with the peritoneal cavity, warrant surgical evaluation due to the risk of associated inguinal hernias or complications [7]. Testicular torsion, on the other hand, is a surgical emergency that presents with acute scrotal pain and absent blood flow on Doppler ultrasound, necessitating immediate intervention. The hallmark of testicular torsion on Doppler imaging is the absence or significant reduction in blood flow within the affected testicle, which is critical because prompt surgical intervention is required to restore blood flow and prevent testicular necrosis. Outcomes are best when surgery is performed within 6 hours of symptom onset [9]. Differentiating between torsion and incarcerated hernia is vital, as both can lead to testicular ischemia, but torsion typically shows a complete lack of blood flow on Doppler ultrasound, whereas hernia might not exhibit such findings [8]. Epididymitis, though rare in this age group, may also be considered, particularly in the presence of systemic symptoms such as fever, which are atypical in cases of hernia. Epididymitis is often associated with fever, irritability, and scrotal pain, which can be

misinterpreted as conditions like torsion or hernia. The diagnosis is critical as treatment differs significantly, with antibiotics being the mainstay in bacterial cases [10]. Lastly, while testicular tumors are exceedingly rare in infants, they should not be overlooked in cases of persistent, firm scrotal masses. These tumors may present with heterogeneous features on imaging, such as mixed echogenicity, and often necessitate thorough evaluation via ultrasound to differentiate them from other conditions. Early diagnosis and prompt surgical intervention are essential for optimal outcomes [11].

Premature infants, in particular, exhibit a higher incidence of inguinal hernias, with some studies reporting prevalence rates up to 30% in this population, likely due to delayed closure of the processus vaginalis. Such data emphasize the importance of systematic screening and timely referral for surgery [1, 2]. Furthermore, while laparoscopic approaches are associated with faster recovery, emerging evidence suggests a slightly higher recurrence rate in younger infants compared to open repair, underscoring the importance of individualizing treatment plans [2].

Inguinal hernias are a common pediatric surgical condition, with an estimated incidence of 1–5% in live births. Untreated hernias carry a significant risk of complications, including bowel strangulation, which occurs in approximately 30% of cases, potentially leading to ischemia, necrosis, or perforation [2].

Ultrasonography, particularly with high-frequency linear transducers and Doppler imaging, plays a pivotal role in confirming the diagnosis. Visualization of intestinal peristalsis within the scrotum and preserved blood flow to testicular structures are key features aiding diagnosis. Its non-invasive nature, high sensitivity, and ability to detect vascular compromise make ultrasound indispensable in pediatric patients [1].

Early diagnosis in pediatric cases is crucial, as delayed intervention in conditions like scrotal hernias can result in testicular atrophy or long-term fertility issues due to ischemic damage [4]. Research highlights that testicular atrophy and impaired spermatogenesis can result from prolonged vascular compromise, emphasizing the critical need for timely intervention to minimize long-term reproductive consequences [11]. This underscores the importance of vigilance in evaluating scrotal swelling, even in asymptomatic infants [5].

From a public health perspective, timely diagnosis and intervention for scrotal hernias are crucial, especially in resource-limited settings where delayed surgical care may increase

morbidity. This highlights the role of educating primary care providers and parents on recognizing early signs of scrotal swelling, thereby reducing delays in referral and treatment.

Conclusions

Ultrasound is an essential first-line diagnostic tool for evaluating scrotal enlargement in infants. It facilitates accurate differentiation between causes and supports timely surgical planning. Proper surgical intervention, whether open or laparoscopic, is safe and effective, with minimal risk of recurrence or complications. Early diagnosis and treatment remain critical to ensuring optimal outcomes in these patients.

Disclosure

Author`s contribution:

Conceptualization: Bartosz Rutka

Methodology: Bartosz Rutka, Martyna Rutka, Adam Niedziela

Software: Bartosz Rutka, Martyna Rutka, Dominik Domoń

Formal analysis: Bartosz Rutka, Martyna Rutka, Adam Niedziela, Dominik Domoń

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Data curation: Bartosz Rutka, Martyna Rutka, Adam Niedziela, Dominik Domoń

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Visualization: Bartosz Rutka, Martyna Rutka

Supervision: Bartosz Rutka, Martyna Rutka

Project administration: Bartosz Rutka, Martyna Rutka

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The authors declare no conflict of interest.

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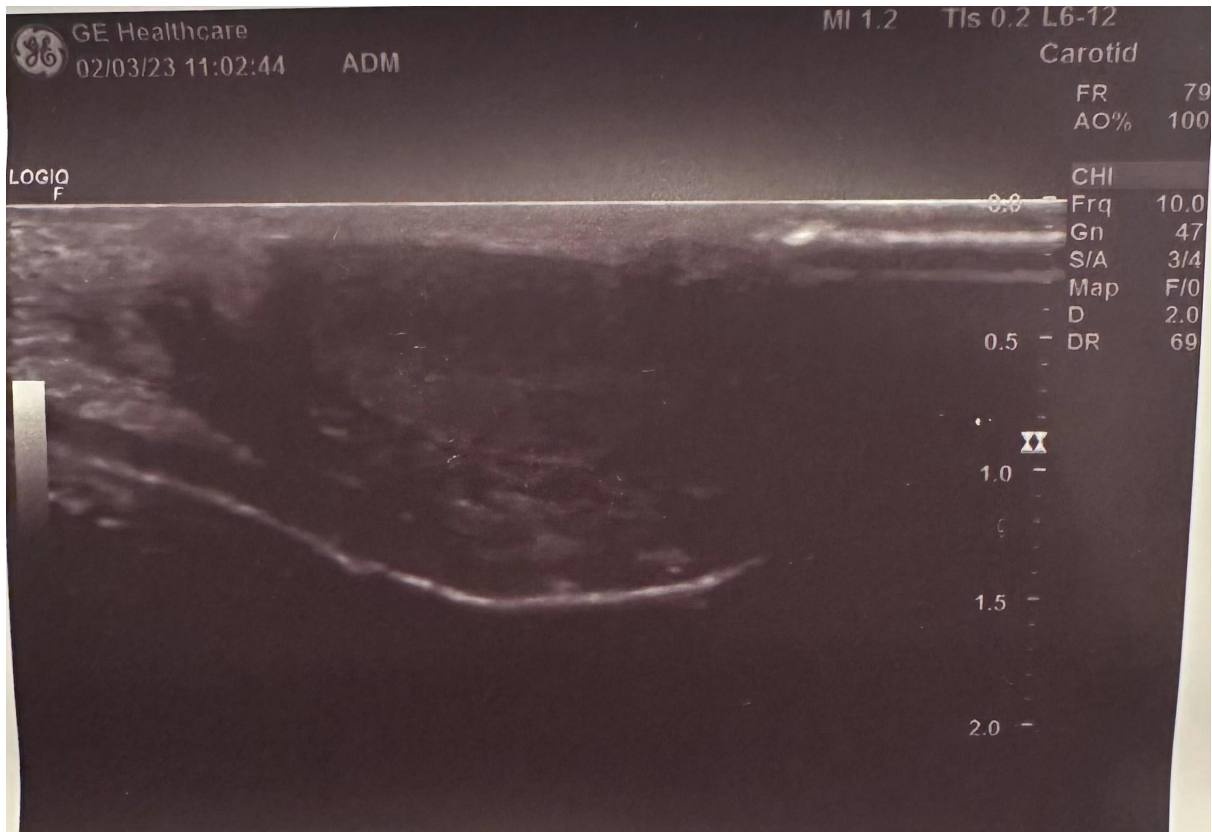


Fig. 1. Longitudinal ultrasound scan of the scrotal sac showing a hypoechoic testis with a hyperechoic intestinal loop located above it.

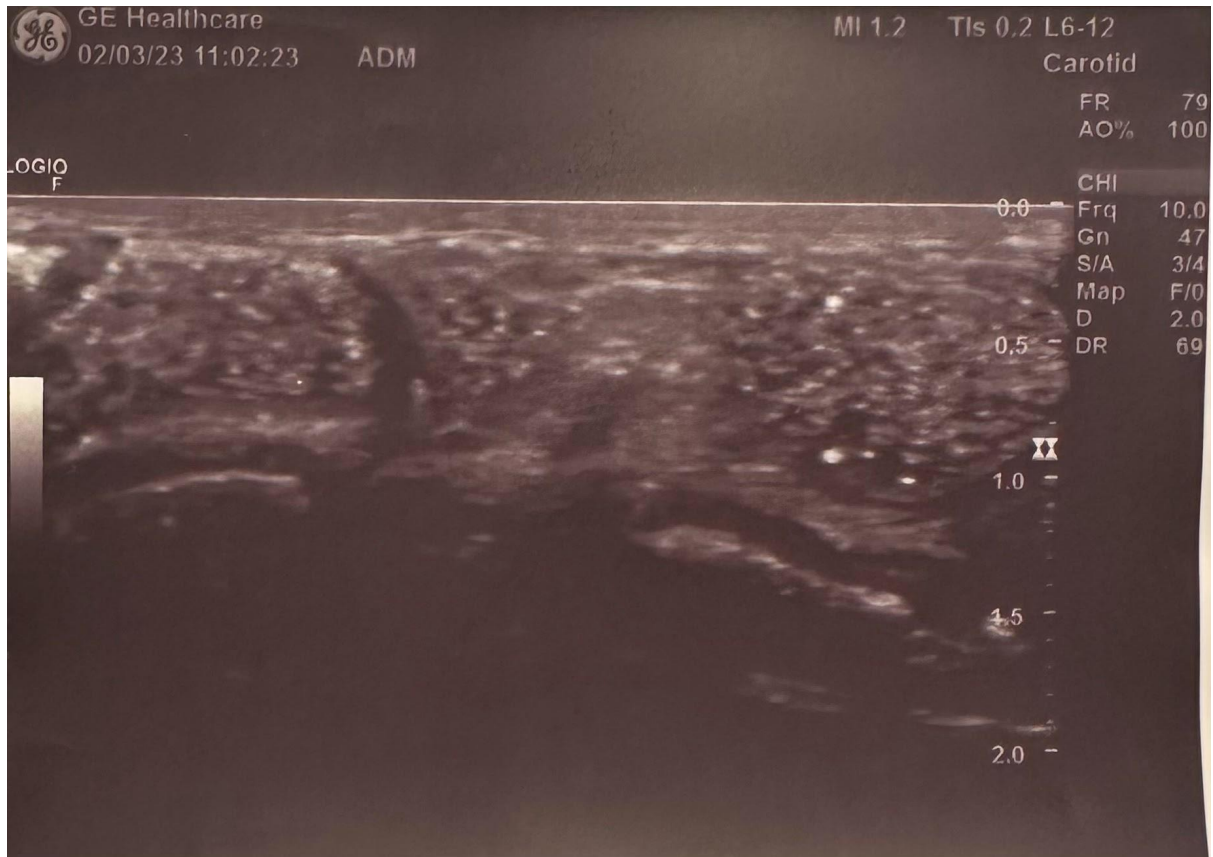


Fig. 2. Longitudinal ultrasound scan of the inguinal canal with a hyperechoic intestinal loop containing gas bubbles.

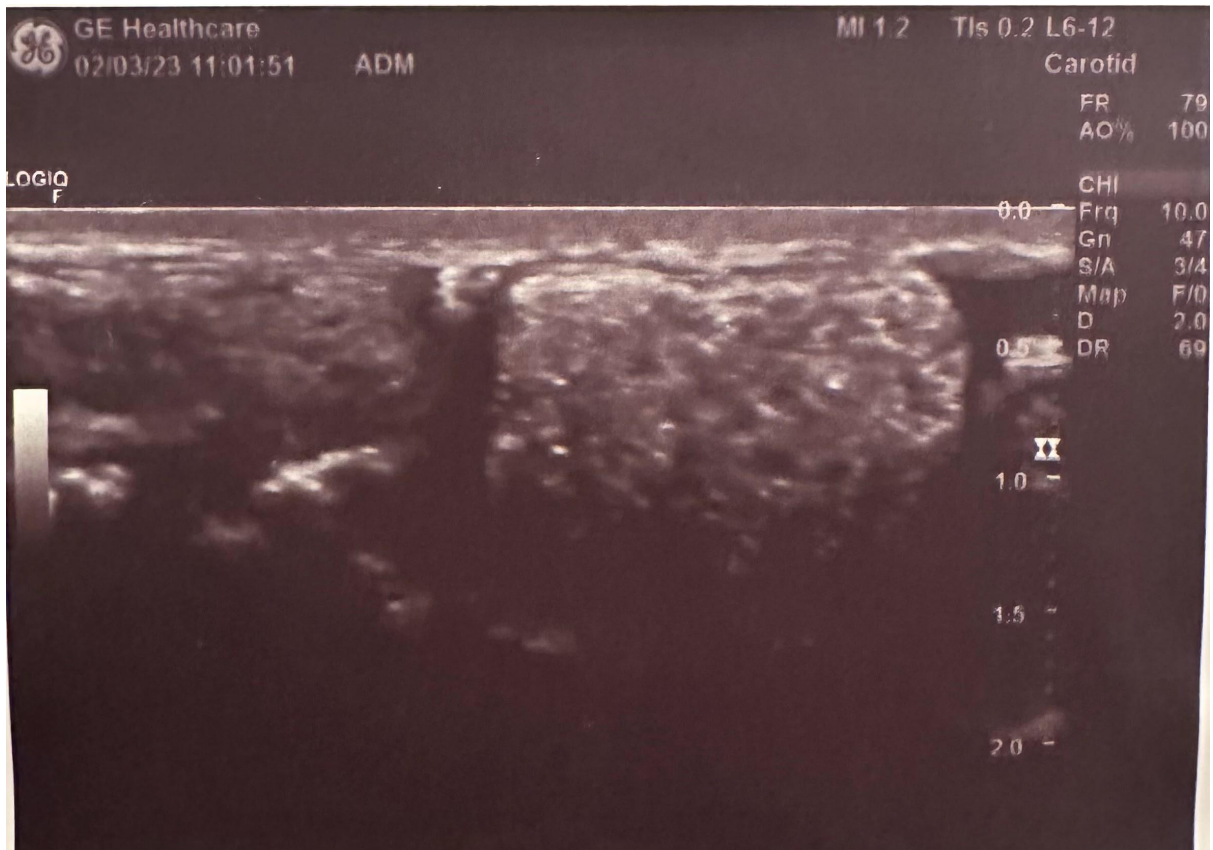


Fig. 3. Transverse ultrasound scan of a hyperechoic intestinal loop with gas bubbles within the inguinal canal.